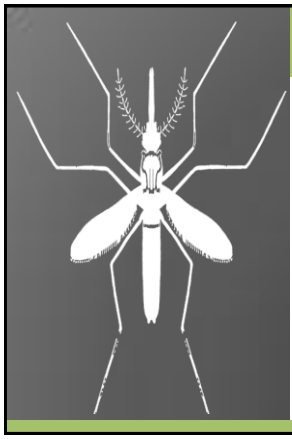


Michigan Arbovirus and Emerging Disease Update

Kimberly Signs, DVM
Michigan Department of Community Health

Agenda

- Mosquito-borne disease
  - 2014 Arbovirus season
    - Plans for 2014-15
  - Chikungunya in the Americas
- Ebola in West Africa

West Nile Virus

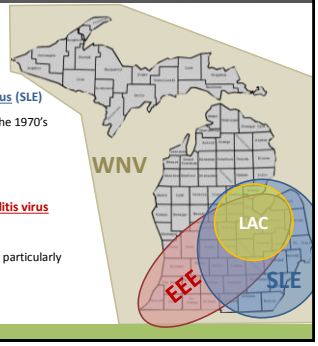
Summary of 2014 surveillance, and projects for the 2014-15 season.

West Nile Virus

- Second-most commonly reported vector-borne disease in the U.S.
  - Lyme disease #1
- Mosquito-borne *Flavivirus* infection
- First identified in the U.S. in 1999 (NYC)
- First detected in mosquitoes and birds in Michigan in 2001
- Since its introduction to MI, is the cause of 1133 human illnesses and 92 deaths
- Illnesses usually occur July – October

Geographic Distribution of Arboviruses in Michigan

- West Nile virus (WNV)
  - *Flavivirus*
  - First detected in the state in 2001→now endemic
- St. Louis Encephalitis virus (SLE)
  - *Flavivirus*
  - Historic outbreak in the 1970's
  - Sporadic cases
- LaCrosse virus (LAC)
  - *Bunyavirus*
  - Sporadic cases
- Eastern Equine Encephalitis virus (EEE)
  - *Alphavirus*
  - Sporadic cases
  - Occasional outbreaks particularly in horses
- Powassan virus
  - *Flavivirus*
  - *Tick-borne*



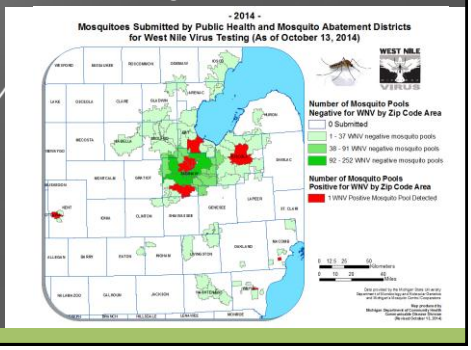
2014 Mosquito Surveillance

- Mosquito samples were submitted from the following counties:
  - Arenac
  - Bay
  - Eaton
  - Genesee
  - Gladwin
  - Ingham
  - Iosco
  - Isabella
  - Kent*
  - Livingston
  - Macomb*
  - Midland
  - Saginaw
  - Tuscola
  - Washtenaw*
  - Wayne*

Majority of mosquito pools tested by Dr. Mike Kaufman, MSU Dept. of Entomology, * tested initially using Vec-Test

Arbovirus	Pools Tested	Mosquitoes Tested	Positive Pools
West Nile Virus (WNV)	2154	23289	10
St. Louis Encephalitis (SLE)	1292	10184	0
La Crosse (LAC)	458	3147	1
Eastern Equine Encephalitis (EEE)	203	5081	0
Totals	4107	41701	11

Geography of Mosquito Surveillance-2014



2014 Michigan Arbovirus Surveillance

Avian:
- 13 corvids
- 9 "other" species
- Collected 6/18 – 9/19

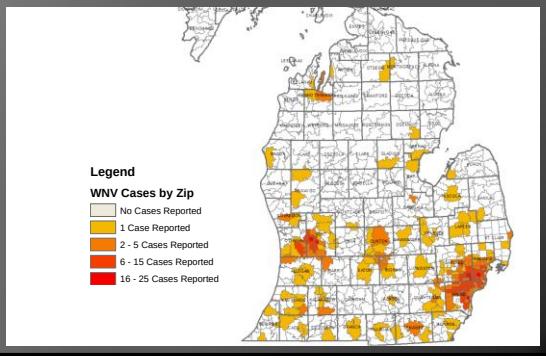
Equine:
- 1 WNV+ horse
  - Onset date 8/9
- 4 EEE+ horses
  - Oakland (1) and Lenawee (3) Counties
  - Onset dates 9/5-9/13

Human:
- 1 WNV + case (Kent)
- 1 WNV viremic donor (Cass)
- 1 EEE + case (Van Buren)

West Nile virus incidence in Michigan

- Responsible for 1,133 reported human illnesses and 92 deaths in Michigan since 2002
- Majority of WNV cases are associated with urban areas in the Detroit Metro and Grand Rapids Metro areas
- Mosquito surveillance for arboviruses in these regions is historically limited or not conducted

WNV Geography in MI: 2002-2012



WNV Cases in Michigan

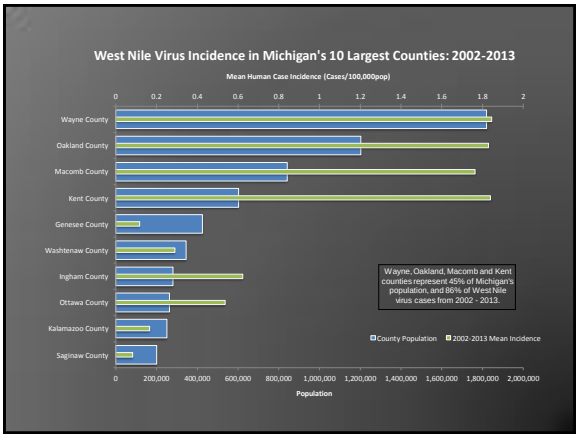
63% of Michigan Population

92% of reported WNV

45% of Michigan Population

86% of reported WNV

County	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Saginaw	2	0	0	0	0	0	0	0	0	0	0	0	**2**
Kalamazoo	3	0	1	0	0	0	0	0	0	0	1	0	**5**
Ottawa	12	0	0	1	1	0	0	0	1	0	1	1	**17**
Ingham	8	1	0	1	1	0	0	0	0	4	6	0	**21**
Washtenaw	1	0	0	3	1	0	0	0	2	0	4	1	**12**
Genesee	1	0	0	1	3	0	0	0	0	1	0	0	**6**
Kent	60	0	2	11	13	2	2	0	1	1	41	0	**133**
Macomb	112	4	0	5	2	3	2	0	11	8	28	3	**178**
Oakland	214	3	2	5	4	2	0	0	5	2	23	4	**264**
Wayne	203	10	9	28	15	7	9	1	8	13	84	6	**403**



Mosquito Surveillance Objectives

Mosquito surveillance has the potential to provide early detection of arbovirus activity, and can be used to guide intervention strategies that ultimately reduce human risk for infection

- To define the demographic, temporal, and geographic distribution of WNV
- To detect outbreaks or new arboviruses
- To guide or evaluate disease control strategies
- To assess cost of arbovirus presence in the community
- Infection rates in mosquito pools have predictive value for human outbreaks
- To facilitate planning

New Jersey Light Trap

2014 Community Mosquito Surveillance Initiative

- Improve our knowledge of mosquito infection rates in endemic, high-risk counties
- Provide information about WNV risk to Michigan's public and healthcare providers
- Contribute to national WNV knowledge through participation in ArboNET
- Promote mosquito surveillance and control
- Actionable information collected at the local level may potentially guide public health response in the event of a large-scale outbreak

MDCH Supplied to LHD's

- VectorTest kits
  - 100 tests/county to start, additional if funds available
- Mosquito traps if not already available at LHD
- Training session for staff
  - Mosquito sorting and ID
  - Use of VectorTest kits
  - Trap operation and placement
- Electronic file for collection/transmission of mosquito testing data to MDCH
- GIS mapping support to counties

Early Results

- $24,000 in grants to 4 counties (Wayne, Macomb, Washtenaw, and Kent)
  - MDCH conducted surveillance in Ingham and Clinton Counties
- Mosquito trapping for *Culex* sp. vectors conducted from early June through the end of September
- 357 total mosquito pools tested representing 5,674 mosquitoes

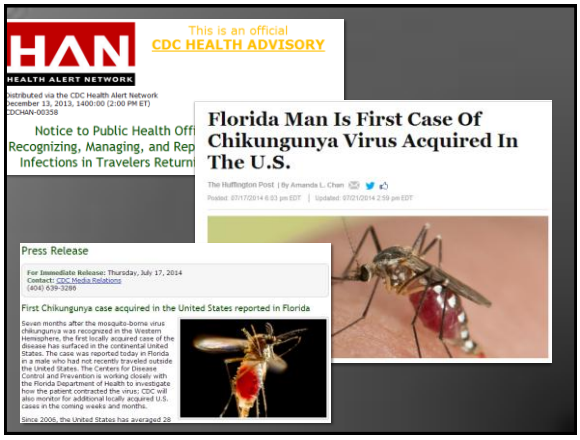
Early Results

- Good community relations and outreach
- Positive mosquito pools were identified in Kent, Wayne, and Macomb counties
  - Resulted in multiple press releases educating the public regarding West Nile virus prevention
  - Kent Co. instituted larval mosquito control w/in 5 mile radius of positive mosquito pool
- To date, only one WNV human case and one viremic blood donor have been reported in Michigan
- Funding likely available to continue and hopefully expand the project in 2015


Fight the Bite: Wayne County's Environmental Health Division works to reduce West Nile Virus

Chikungunya

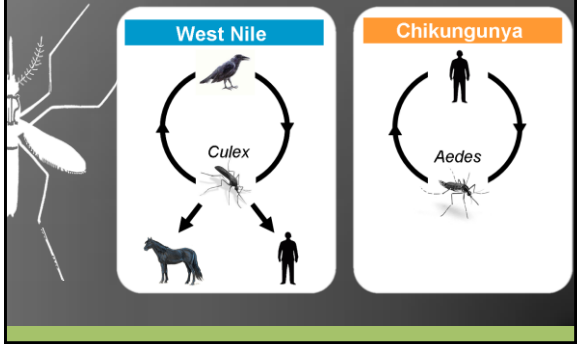
Emerging mosquito-borne disease in the Americas



Chikungunya in the Americas

- December 2013: Reports of the first, local transmission of Chikungunya (CHIKV) virus in the Americas
- Alphavirus transmitted by *Aedes aegypti* and *Aedes albopictus* mosquitoes
- First described in 1952 following an outbreak in the region that is now Tanzania
  - Previous outbreaks have occurred in countries in Africa, Asia, Europe, and the Indian and Pacific Oceans

Transmission Cycle



Chikungunya

- 'Chikungunya' means 'that which bends up' in the Kimakonde language of Mozambique
- Incubation period is usually 3-7 days
- Majority of people (72-97%) infected with CHIKV become symptomatic
- Usually not fatal (<0.1%)
- Risk groups are the very young, those over 65 years, and persons with underlying medical conditions
- Immunity is likely lifelong

Symptoms of Chikungunya

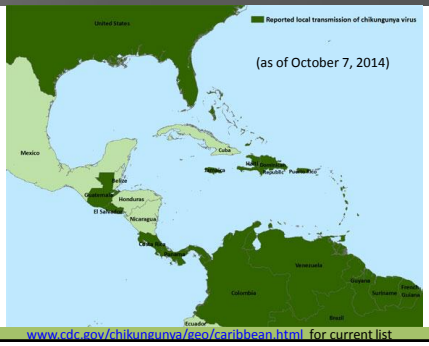
- Polyarthralgia--Joint pain
  - Often severe and debilitating
  - Involves multiple joints
  - Usually bilateral and symmetric
  - Most common in hands and feet
- Fever
  - Abrupt onset
  - Typically ≥39.0°C (≥102.2°F)

Other clinical signs and symptoms

- Headache
- Myalgia
- Arthritis
- Conjunctivitis
- Nausea/vomiting
- Maculopapular rash

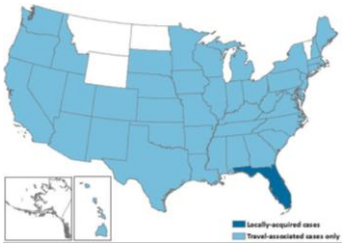
PAINFUL: A large number of people in Pushpagiri near Mysore have displayed symptoms such as swelling of joints. — The Hindu.
PHOTO: M.A. SRIRAM

Countries and Territories in the Americas Where Chikungunya Cases Have Been Reported



www.cdc.gov/chikungunya/geo/caribbean.html for current list

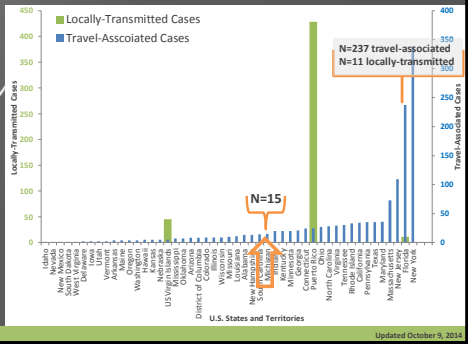
States with Ckikungunya Cases Reported



- July 2014: First local transmission of chikungunya virus in the continental United States (Florida)

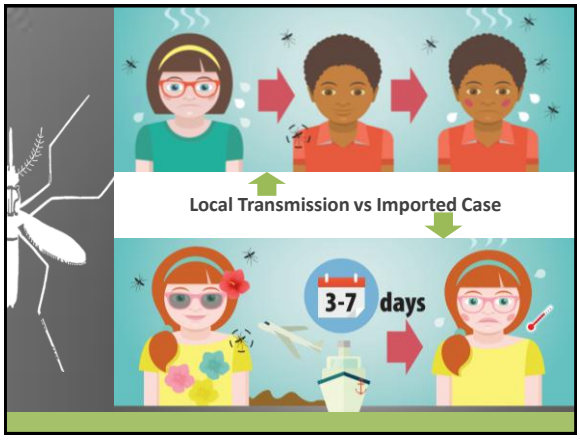
Updated October 9, 2014

States and Territories with Ckikungunya Cases Reported



Updated October 9, 2014

So what's the difference between a travel associated case and a locally transmitted case?



More chikungunya-infected travelers coming into the U.S. increases the likelihood that local chikungunya transmission will occur.

The Culprit

- Mosquito vectors
  - *Aedes aegypti* and *Aedes albopictus*
  - Same mosquitoes that transmit dengue
- Widely distributed throughout Americas

Aedes aegypti

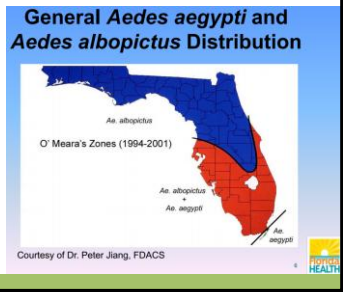
- Important vector in urban areas
- Larval habitats are typically containers on the household premises

Aedes albopictus

- More likely to play a larger role in transmission in the U.S. due to its wide distribution
- Larvae occur in peri-domestic habitats as well as surrounding natural habitats

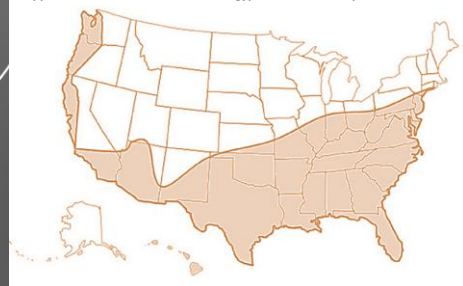
Locally transmitted cases in Florida are not a surprise.

- Both mosquitos transmitting chikungunya are found in Florida



Is Michigan at risk for locally transmitted chikungunya?

Approximate Distribution of *Aedes aegypti* and *Aedes albopicttus* in the U.S.



Germán Añez and Maria Rios, "Dengue in the United States of America: A Worsening Scenario?," BioMed Research International, vol. 2013, Article ID 678645, 13 pages, 2013. doi:10.1155/2013/678645

Reporting of Chikungunya Cases

Not a nationally notifiable disease in the U.S.; *however*
suspected cases are asked **to be reported** into MDSS.

- MDCH reports laboratory-confirmed cases to CDC via ArboNET (National arboviral surveillance system)
- Visit www.michigan.gov/cdinfo , Communicable Diseases A-Z, for Michigan's "Chikungunya virus Guidance for Local Health Departments and Healthcare Providers"

MDCH CHIKV Resources

Image: Centers for Disease Control and Prevention

MDCH

BOARDING PASS

TRAVELER/CARIBBEAN
VECTOR-BORNE DISEASES: KNOW BEFORE YOU TRAVEL

VECTORS
Like the yellow fever mosquito & Asian tiger mosquito

CAUSE
Serious diseases such as:
- Dengue
- Chikungunya (chik-un-gun-ya)

DISEASE
Watch for symptoms including:
- Fever
- Joint pain or swelling
- Severe headache, muscle pain, or rash

WORLD TRAVELER
Find travel notices, destination information, and travel clinic info at www.cdc.gov/travel

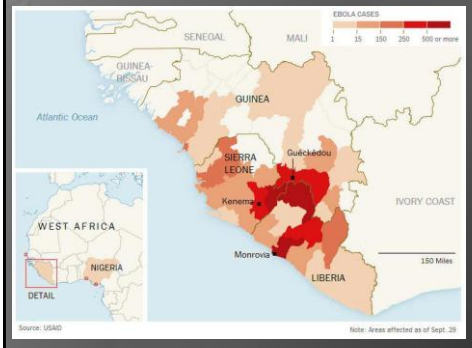
MDCH

SMALL BITE, BIG THREAT
TAKE SIMPLE STEPS TO PROTECT YOURSELF AND YOUR FAMILY

SEE REVERSE 1A

GATE A 37
SEAT 15 E
ZONE 2
Non-smoking flight

Ebola



Ebola West African outbreak and Michigan guidelines

2014 West Africa Outbreak

- Largest outbreak of Ebola Virus Disease (EVD) ever documented
  - First recorded outbreak in West Africa
- More than 4,000 deaths
  - Case fatality rate is 55%-60%
- 2 confirmed case have been reported in the U.S.--TX
  - Index case from Liberia
  - TX Healthcare worker providing care for index case

Countries Affected in West Africa

The Numbers

Total Cases *(as of October 8, 2014)*
Total Case Count: 8376
Total Deaths: 4024
Laboratory Confirmed Cases: 4633

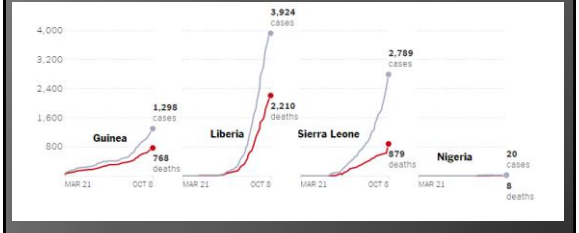
Liberia	Guinea	Sierra Leone
Total Case Count: 4076	Total Case Count: 1350	Total Case Count: 2950
Total Deaths: 2316	Total Deaths: 778	Total Case Deaths: 930

Senegal
Total Case Count: **1**
Total Case Deaths: **0**
(no new cases since 8/29/14)

Nigeria
Total Case Count: **20**
Total Case Deaths: **8**
(no new cases since 9/5/14)

Without additional interventions, CDC estimates that by January 20, 2015, there will be a total of approximately 550,000 to 1.4 million cases of Ebola in Liberia and Sierra Leone.

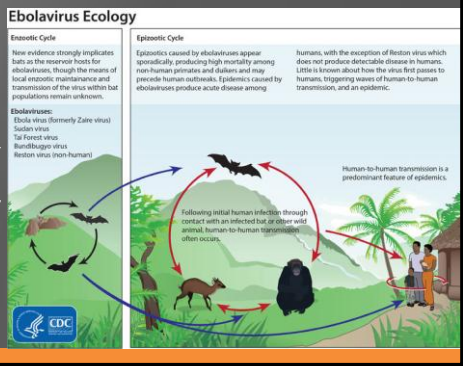
How Many People In Africa Have Been Infected?



Source: The New York Times

Ebola (EVD)

Ebola is typically first spread to humans after contact with infected wildlife and is then spread person-to-person through direct contact with bodily fluids, such as blood, urine, sweat, semen, and breast milk.



Ebola (EVD)

- EVD is characterized by sudden onset of fever (≥ 101.5° F) and malaise, accompanied by one or more of the following:
  - Myalgia
  - Severe headache
  - Abdominal pain
  - Vomiting
  - Diarrhea
- Severe signs or symptoms include:
  - Hemorrhagic symptoms (thrombocytopenia)
    - Petecchia, ecchymosis, bruising
  - Multi-organ dysfunction
    - Hepatic damage, acute kidney disease, and central nervous system involvement
      - Leading to shock and death
- Incubation period is usually 8–10 days (ranges from 2–21 days)
- Virus can be transmitted while infected person is febrile, through later stages of disease, and postmortem

United States and MI Ebola Concern

↑ Aid/Healthcare workers traveling to West Africa

=

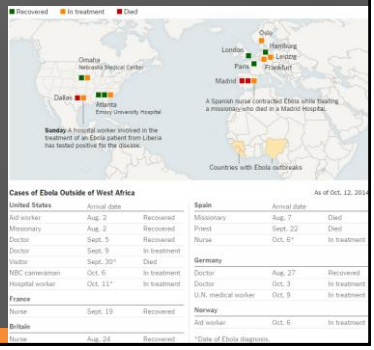
↑ Likelihood of an ill traveler arriving back in the U.S.

*****No outbreak concern in U.S.*****

- The current epidemic does not pose a significant risk to the U.S. public; **however** there is a possibility of an ill traveler returning and presenting in a Michigan hospital.
- CDC has protocols and guidelines to follow regarding:
  - Evaluation of ill travelers
  - Isolation and transport
  - Protecting healthcare workers
  - Testing and laboratory guidelines
  - Environmental cleaning and waste disposal

Cases of Ebola Outside Africa

(as of October 12, 2014)



Cases of Ebola Outside of West Africa As of Oct. 12, 2014

United States	Arrival date	
Aid worker	Aug. 2	Recovered
Missionary	Aug. 2	Recovered
Doctor	Sept. 5	Recovered
Doctor	Sept. 9	In treatment
Visitor	Sept. 30*	Died
NBC cameraman	Oct. 6	In treatment
Hospital worker	Oct. 11*	In treatment
France		
Nurse	Sept. 19	Recovered
Britain		
Nurse	Aug. 24	Recovered

Spain	Arrival date	
Missionary	Aug. 7	Died
Priest	Sept. 22	Died
Nurse	Oct. 6*	In treatment
Germany		
Doctor	Aug. 27	Recovered
Doctor	Oct. 3	In treatment
U.N. medical worker	Oct. 9	In treatment
Norway		
Aid worker	Oct. 6	In treatment

*Date of Ebola diagnosis

Source: The New York Times

Suspected Case-What To Do

- Hospitals should follow their state and/or local health department procedures for notification and consultation for Ebola testing requests before contacting CDC
- CDC cannot accept any specimens without prior consultation
- Contact MDCH for evaluation regarding testing for persons who have traveled to an EVD-affected country within 21 days (Guinea, Liberia, Sierra Leone) and present with symptoms
  - If testing is indicated, immediately notify MDCH
    - 517-335-8165 M-F, 8:00 AM-5 PM
    - 517-335-9030 after hours and weekends

Person Under Investigation (PUI)

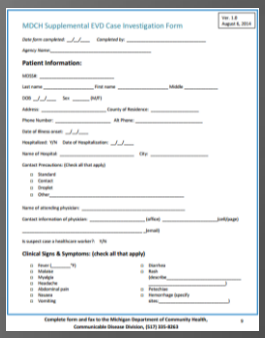
A person who has both consistent symptoms and risk factors as follows:

- Clinical criteria, which includes fever of greater than 38.6 degrees Celsius or 101.5 degrees Fahrenheit, and additional symptoms such as severe headache, muscle pain, vomiting, diarrhea, abdominal pain, or unexplained hemorrhage;

AND

- Epidemiologic risk factors within the past 21 days before the onset of symptoms, such as residence in—or travel to—an area where EVD transmission is active; contact with blood or other body fluids or human remains of a patient known to have or suspected to have EVD; or direct handling of bats or non-human primates from disease-endemic areas.

EVD Case Investigation Form


MDCH Supplemental EVD Case Investigation Form

Ver. 1.0
August 6, 2014

Date form completed: __/__/____ Completed by: _____

Agency Name: _____

Patient Information:

MDSS#: _____

Last name _____ First name _____ Middle _____

DOB __/__/____ Sex _____ (M/F)

Address _____ County of Residence: _____

Phone Number: _____ Alt Phone: _____

Date of Illness onset: __/__/____

Hospitalized Y/N Date of Hospitalization: __/__/____

Name of Hospital _____ City: _____

Contact Precautions (Check all that apply)

- ☐ Standard
- ☐ Contact
- ☐ Droplet
- ☐ Other _____

Name of attending physician: _____

Contact information of physician _____ (office) _____ (cell/page)

_____ (email)

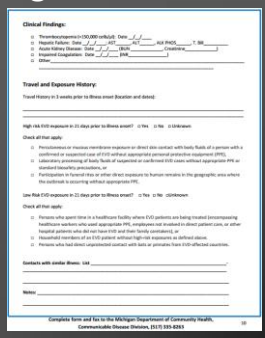
Is suspect case a healthcare worker? Y/N

Clinical Signs & Symptoms: (check all that apply)

- ☐ Fever (subjective) °F
- ☐ Malaise
- ☐ Myalgia
- ☐ Headache
- ☐ Abdominal pain
- ☐ Nausea
- ☐ Vomiting
- ☐ Diarrhea
- ☐ Rash (describe _____)
- ☐ Petechiae
- ☐ Hemorrhage (specify site _____)

Complete form and fax to the Michigan Department of Community Health, Communicable Disease Division, (517) 335-8263

9


Clinical Findings:

- ☐ Thrombocytopenia (<150,000 cells/µl): Date __/__/____
- ☐ Hepatic Failure: Date __/__/____ AST _____ ALT _____ Alk PHOS _____ T. Bili _____
- ☐ Acute Kidney Disease: Date __/__/____ BUN _____ Creatinine _____
- ☐ Impaired Coagulation: Date __/__/____ PTT _____ INR _____
- ☐ Other _____

_____

Travel and Exposure History:

Travel History in 3 weeks prior to Illness onset (location and dates):

_____

_____

High risk EVD exposure in 21 days prior to Illness onset? ☐ Yes ☐ No ☐ Unknown

Check all that apply:

- ☐ Percutaneous or mucous membrane exposure or direct skin contact with body fluids of a person with a confirmed or suspected case of EVD without appropriate personal protective equipment (PPE),
- ☐ Laboratory processing of body fluids of suspected or confirmed EVD cases without appropriate PPE or standard laboratory precautions, or
- ☐ Participation in funeral rites or other direct exposure to human remains in the geographic area where the outbreak is occurring without appropriate PPE.

Low Risk EVD exposure in 21 days prior to Illness onset? ☐ Yes ☐ No ☐ Unknown

Check all that apply:

- ☐ Persons who spent time in a healthcare facility where EVD patients are being treated (encompassing healthcare workers who used appropriate PPE, employees not involved in direct patient care, or other hospital patients who did not have EVD and their family caretakers), or
- ☐ Household members of an EVD patient without high-risk exposures as defined above.
- ☐ Persons who had direct unprotected contact with bats or primates from EVD-affected countries.

Contacts with similar Illness: List _____

_____

_____

_____

Notes: _____

_____

_____

Complete form and fax to the Michigan Department of Community Health, Communicable Disease Division, (517) 335-8263

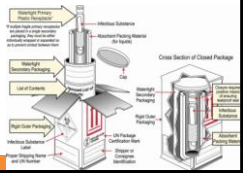
10

Specimen Collection, Transport, Testing, and Submission

Interim Guidance for Specimen Collection, Transport, Testing, and Submission for Persons Under Investigation for Ebola Virus Disease in the United States

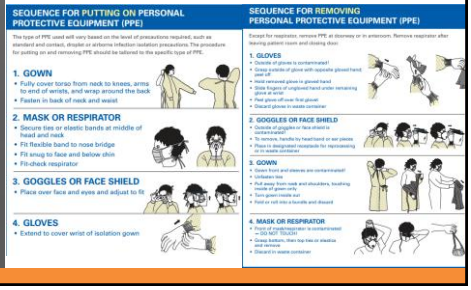
- U.S. clinical laboratories can safely handle specimens from these potential Ebola patients by taking all required precautions and practices in the laboratory, specifically designed for pathogens spread in the blood (BSL 2 precautions)
- MDCH Bureau of Laboratories can test for Ebola Virus only after consultation with MDCH and CDC approval

Packaging and Shipping Clinical Specimens Diagram



Protecting Healthcare Workers

- Guidance provided by CDC on proper donning and doffing of personal protective equipment (PPE)


SEQUENCE FOR PUTTING ON PERSONAL PROTECTIVE EQUIPMENT (PPE)

The type of PPE used will vary based on the level of precautions required, such as standard and contact, droplet or airborne infection isolation precautions. The procedure for putting on and removing PPE should be tailored to the specific type of PPE.

1. GOWN
- Fully cover torso from neck to knees, arms to end of wrists, and wrap around the back
- Fasten in back of neck and waist

2. MASK OR RESPIRATOR
- Secure ties or elastic bands at middle of head and neck
- Fit flexible band to nose bridge
- Fit snug to face and below chin
- Fit-check respirator

3. GOGGLES OR FACE SHIELD
- Place over face and eyes and adjust to fit

4. GLOVES
- Extend to cover wrist of isolation gown

SEQUENCE FOR REMOVING PERSONAL PROTECTIVE EQUIPMENT (PPE)

Except for respirator, remove PPE at doorway or in anteroom. Remove respirator after leaving patient room and closing door.

1. GLOVES
- Outside of gloves is contaminated!
- Grasp outside of glove with opposite gloved hand; peel off
- Hold removed glove in gloved hand
- Slide fingers of ungloved hand under remaining glove at wrist
- Peel glove off over first glove
- Discard gloves in waste container

2. GOGGLES OR FACE SHIELD
- Outside of goggles or face shield is contaminated!
- To remove, handle by headband or ear pieces
- Place in designated receptacle for reprocessing or in waste container

3. GOWN
- Gown front and sleeves are contaminated!
- Unfasten ties
- Pull away from neck and shoulders, touching inside of gown only
- Turn gown inside out
- Fold or roll into a bundle and discard

4. MASK OR RESPIRATOR
- Front of mask/respirator is contaminated — DO NOT TOUCH!
- Grasp bottom, then top ties or elastic and remove
- Discard in waste container

CDC PPE Guidance




- All persons entering patient rooms should wear at least:
  - Gloves
  - Gown (fluid resistant or impermeable)
  - Eye protection (goggles or face shield)
  - Facemask
- Additional PPE might be required in certain situations
  - Double gloves
  - Disposable shoe covers
  - Leg coverings
  - N-95 respirator or equivalent if AGPs are being conducted
- WHATEVER PPE IS USED, IT IS CRITICAL THAT ALL STAFF BE COMFORTABLE AND PRACTICE SAFE DONNING AND DOFFING PROCEDURES FOR THE PPE THEY WILL BE EXPECTED TO WORK IN.

Resources for Updates and Guidance

Michigan Ebola Site
www.michigan.gov/ebola

CDC Guidelines and Updates
www.cdc.gov/ebola

Questions?